

**PATENT APPLICATION**

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

In re application of

Docket No: Q88367

Jun YAMAMOTO

Appln. No.: 10/539,020

Group Art Unit: 1793

Confirmation No.: 7381

Examiner: Kenneth VADEN

Filed: June 15, 2005

For: PROCESS FOR PRODUCING TITANIUM-CONTAINING SILICON OXIDE  
CATALYST

**SUBMISSION OF APPEAL BRIEF**

**MAIL STOP APPEAL BRIEF - PATENTS**

Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Sir:

Submitted herewith please find an Appeal Brief. Since October 30, 2010 fell on a Saturday, the filing of the Appeal Brief on Monday, November 1, 2010 is timely. The statutory fee of \$540.00 is being remitted. The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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WASHINGTON OFFICE

**23373**

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Date: November 1, 2010

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**APPEAL BRIEF UNDER 37 C.F.R. § 41.37**

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Commissioner for Patents

P.O. Box 1450

Alexandria, VA 22313-1450

Sir:

In accordance with the provisions of 37 C.F.R. § 41.37, Appellant submits the following:

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**I. REAL PARTY IN INTEREST**

SUMITOMO CHEMICAL COMPANY, LIMITED having a business address of 27-1, Shinkawa 2-chome Chuo-ku Tokyo, JAPAN is the real party in interest. An assignment was filed on June 15, 2005 and recorded at Reel 017443, Frame 0496.

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**II. RELATED APPEALS AND INTERFERENCES**

Appellant, Appellant's legal representatives, and the Assignee of this application are not aware of any other appeals or interferences that will directly affect, or be affected by, or have a bearing on the Board's decision in the pending appeal.

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**III. STATUS OF CLAIMS**

Claims 1-10 stand rejected and are the subject of this appeal.

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**IV. STATUS OF AMENDMENTS**

No amendments were submitted after the final rejection of the claims in the December 31, 2009 Office Action.

**V. SUMMARY OF THE CLAIMED SUBJECT MATTER**

Present Claim 1 relates to a process for producing a titanium-containing silicon oxide catalyst satisfying all of the following conditions (1) to (3) (page 2, lines 9-12 of the specification):

- (1) the average pore diameter is 10Å or more (page 2, line 13 of the specification),
- (2) 90% or more of the total pore volume has a pore diameter of 5 to 200Å (page 2, lines 14-15 of the specification), and
- (3) the specific pore volume is 0.2 cm<sup>3</sup>/g or more (page 2, line 16 of the specification).

The process includes the following first to fourth steps (page 2, line 17 of the specification):

first step: a step of obtaining a solid containing a catalyst component and a template by mixing and stirring a silica source, a titanium source and a quaternary ammonium ion as a template in a liquid state (page 2, lines 18-21 of the specification);

second step: a step of removing the template from the solid obtained in the first step by solvent extraction (page 2, lines 22-23 of the specification);

third step: a step of substituting the solvent used for the extraction which was contained in the solid after the removal of the template, with a solvent which is substantially inert to a silylating agent to be used in the following fourth step (page 2, lines 24-28 of the specification); and

fourth step; a step of obtaining a silylated catalyst by subjecting the solid obtained in the third step to silylation (page 2, line 29 to page 3, line 2 of the specification).

Although portions of the specification have been referred to in the summary, the references to portions of the specification are not meant to be limiting in nature, but rather as references to disclosed exemplary embodiments.

**VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

The grounds of rejection to be reviewed, including the statute applied, the claims subject to each rejection and the references relied upon by the examiner are as follows:

Claims 1-10 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Yamamoto et al. (US 6,323,147).

Claim 9 has been rejected for obviousness-type double patenting as being unpatentable over Claim 1 of U.S. Patent No. 6,323,147.

## **VII. ARGUMENT**

### **I. Claims 1-10 are patentable over Yamamoto et al.**

The § 103(a) rejection of Claims 1-10 based on Yamamoto et al. should be reversed because Yamamoto et al. fails to disclose or render obvious the present claimed invention.

The claimed invention relates to a process for producing a titanium-containing silicon oxide catalyst as defined in Claim 1. The invention is also directed to the catalyst obtained by the recited process. The catalyst can be used for reactions for preparing, for example, an oxirane compound from a hydroperoxide and an olefin type compound, and can exhibit high activity.

The presently claimed process comprises the following first to fourth steps:

first step: a step of obtaining a solid containing a catalyst component and a template by mixing and stirring a silica source, a titanium source and a quaternary ammonium ion as a template in a liquid state;

second step: a step of removing the template from the solid obtained in the first step by solvent extraction;

third step: a step of substituting the solvent used for the extraction which was contained in the solid after the removal of the template, with a solvent which is substantially inert to a silylating agent to be used in the following fourth step; and

fourth step; a step of obtaining a silylated catalyst by subjecting the solid obtained in the third step to silylation.

A significant aspect of the present claimed invention is in the third step, that is, to substitute the template extraction solvent remaining in the solid after the removal of the template (second step), with a solvent substantially inert to the silylating agent to be used in the following fourth step.

Yamamoto et al. does not disclose or teach the third step of present Claim 1, in which the template extraction solvent remaining in the solid after the removal of the template, is substituted with a solvent substantially inert to the silylating agent to be used in the following silylation step (fourth step).

A comparison between Example 1 and Comparative Example 1 of the specification shows that there was improvement in the reaction result when the treatment from extraction to silylation was substitution with toluene (Example 1) versus drying with hot nitrogen (Comparative Example 1, which is representative of Yamamoto et al.). See Table 1 at page 21 of the specification.

Specifically, as shown in Table 1, the obtained catalyst in Example 1 after silylation showed improved reactivity when used to produce propylene oxide (PO) from propylene (C<sub>3</sub>') and cumene hydroperoxide.

More specifically, in the presently claimed process (Example 1), the selectivity of PO/C<sub>3</sub>' is 99.1% while that shown by the catalyst treated under the nitrogen atmosphere was 98.7% in Comparative Example 1, which is representative of Yamamoto et al. The difference of 0.4% between the two values may seem modest at a glance. However, on an industrial scale of production, PO is reportedly produced around 3 million tons or so each year across the world,

and at least 0.3 million tons may be produced at one PO production site. Taking into account such large industrial scale production, it can be properly said that 0.4% of improvement equates to 12,000 tons across the world or 1,200 tons at one large production site. Such improvements contribute to save resources and are unexpected for one skilled in the art.

That is, the titanium-containing silicon oxide catalyst obtained by the presently claimed process exhibits unexpectedly higher reactivity than that of Yamamoto et al.

**Errors in the Examiner's Reasoning**

1. The Examiner, at page 4, lines 2-6 of the Office Action dated June 11, 2008, states:

Regarding step three of claim 1, Yamamoto "147" teaches mixing the solid with hexamethyldisilazane and toluene to form a mixture, which corresponds to the claimed step of substituting the solvent used for the extraction which was contained in the solid after the removal of the template, with a solvent which is substantially inert to a silylating agent (Col. 7, lines 47-50).

However, in the above step of Yamamoto et al., the mixing of the solid with hexamethyldisilazane and toluene is conducted for silylation, and this silylation step corresponds to step four of the present Claim 1.

Yamamoto et al. does not disclose or teach step three of present Claim 1, in which the template extraction solvent remaining in the solid after the removal of the template, is substituted with a solvent substantially inert to the silylating agent to be used in the following silylation step (fourth step).

Instead, Yamamoto et al. teaches heating the solid at 150°C for 5 hours under nitrogen flow for drying, in order to remove the template extraction solvent from the catalyst to be silylated. (Col. 7, lines 45-47; Column 4, lines 58-62).

2. In the second paragraph at page 5 of the Office Action dated December 31, 2009, the Examiner states:

Regarding step three of claim 1, Yamamoto “147” also teaches that after the catalyst is mixed with solvent for solvent extraction and the liquid portion separated, the catalyst can be obtained by extracting the catalyst layer with a solvent for washing (col. 4, lines 40-44) and teaches that a solvent used for washing is toluene (col. 7, line 50). Thus if toluene is used for washing after solvent extraction, this obviously results in a third step of substituting the solvent used for extraction with a solvent which is substantially inert to a silylating agent used in a subsequent step, as claimed.

Appellant respectfully disagrees.

Yamamoto et al. teaches, in Example 1 at col. 7, lines 40-50, that the filtered white solid obtained after removal of the templates by extraction with a mixed solution of hydrochloric acid/ethanol was transferred to a tubular furnace and heated at 150 °C for five hours under nitrogen flow; then this substance, hexamethyldisilazane and toluene were mixed, and the mixture was heated for 1 hour under reflux with stirring.

Specifically, Yamamoto et al. at col. 7, lines 45-52 discloses:

... the filtered white solid was transferred to a tubular furnace, heated at 150 °C for 5 hours under nitrogen flow. This substance (5 g),

hexamethyldisilazane (3.4 g) and toluene (50 g) were mixed, and the mixture was heated for 1 hour under reflux with stirring. Liquid was removed by filtration from the mixture. It was washed with toluene (100 g), and dried under reduced pressure ... to obtain a catalyst.

That is, although Yamamoto et al. teaches that a solvent used for washing is toluene, this toluene washing is conducted after silylating the catalyst which corresponds to the fourth step of present Claim 1.

Therefore, the presently claimed solvent substitution procedure (third step) is not employed in Yamamoto et al.'s process, and it took as long as five hours to remove the extraction solvent before the silylation step in Yamamoto et al.

In contrast, in the presently claimed process, the solid after removal of a template was successively washed with a solvent that is substantially inert to the silylating agent, such as toluene, and substitution of the solvent is accomplished as short a time as an hour and 40 minutes (e.g., Example 1 at page 20 of the specification). It is also noted that the obtained catalyst after silylation showed improved reactivity when used to produce propylene oxide (PO) from propylene (C<sub>3</sub>') and cumene hydroperoxide, as discussed above.

3. At page 2, lines 5-6 of the Office Action dated December 31, 2009, the Examiner states that the evidence shown in Table 1 is not commensurate in scope with the claim.

Appellant respectfully disagrees.

The Examiner has not given the evidence the weight that it deserves. In particular, the Examiner has not appreciated that Table 1 (the comparison between Example 1 and Comparative

Example 1 which is representative of Yamamoto et al.) shows how the presently claimed invention exhibits unexpectedly superior results over Yamamoto et al. This is particularly relevant because, as mentioned above, Yamamoto et al. does not teach or suggest the presently claimed third step. Therefore, Table 1 illustrates the presently claimed invention's unexpectedly superior reactivity versus that of Yamamoto et al. Accordingly, Appellant respectfully submits that the Examiner is mistaken, and that the evidence in Table 1, in addition to the arguments set forth above, is sufficient to overcome the §103(a) rejection based on Yamamoto et al.

**II. Claim 9 is not obvious over Claim 1 of U.S. Patent No. 6,323,147.**

The obviousness-type double patenting rejection of Claim 9 based on Claim 1 of U.S. Patent No. 6,323,147 (Yamamoto et al.) should be reversed because Claim 9 is not obvious over Claim 1 of the '147 Patent.

Claim 9 relates to a titanium-containing silicon oxide catalyst obtained by the process according to claim 1.

Claim 9 is not obvious over Claim 1 of the '147 Patent, at least for the reason that the third step of present Claim 1 is not taught or suggested by Claim 1 of the '147 Patent. As discussed above, the titanium-containing silicon oxide catalyst obtained by the presently claimed process exhibits unexpectedly higher reactivity than the catalyst of Yamamoto et al.

**III. Conclusion**

For the above reasons, Appellant respectfully requests reversal of the §103(a) rejection of Claims 1-10 and the double patenting rejection of Claim 9 based on Yamamoto et al.

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The statutory fee (37 C.F.R. §41.37(a) and 1.17(c)) is being remitted. The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

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**CLAIMS APPENDIX**

CLAIMS 1-10 ON APPEAL:

1. A process for producing a titanium-containing silicon oxide catalyst satisfying all of the following conditions (1) to (3);

- (1) an average pore diameter is 10Å or more,
- (2) 90% or more of the total pore volume has a pore diameter of 5 to 200Å, and
- (3) a specific pore volume is 0.2 cm<sup>3</sup>/g or more,

which comprises the following first to fourth steps:

first step: a step of obtaining a solid containing a catalyst component and a template by mixing and stirring a silica source, a titanium source and a quaternary ammonium ion as a template in a liquid state;

second step: a step of removing the template from the solid obtained in the first step by solvent extraction;

third step: a step of substituting the solvent used for the extraction which was contained in the solid after the removal of the template, with a solvent which is substantially inert to a silylating agent to be used in the following fourth step; and

fourth step; a step of obtaining a silylated catalyst by subjecting the solid obtained in the third step to silylation.

2. The process according to claim 1, wherein the solvent for substitution used in the third step is the same as the solvent for silylation used in the fourth step.

3. The process according to claim 1, wherein the template used in the first step is a quaternary ammonium ion represented by the following general formula (I) is used as a template and then the template is removed



wherein, R<sup>1</sup> represents a linear or branched hydrocarbon group having 2 to 36 carbon atoms, and R<sup>2</sup> to R<sup>4</sup> represent an alkyl group having 1 to 6 carbon atoms.

4. The process according to claim 1, wherein the process further comprises a step of molding the solid containing the catalyst component.

5. The process according to claim 1, wherein the solvent for extraction is an alcohol.

6. The process according to claim 5, wherein the alcohol is methanol.

7. The process according to claim 1, wherein the solvent for substitution is a hydrocarbon.

8. The process according to claim 7, wherein the hydrocarbon is toluene.

9. A titanium-containing silicon oxide catalyst obtained by the process according to claim 1.

10. A process for producing an oxirane compound, which comprises reacting an olefin type compound with a hydroperoxide in the presence of the catalyst of claim 9.

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**EVIDENCE APPENDIX**

Pursuant to 37 C.F.R. § 41.37(c)(1)(ix), submitted herewith are copies of any evidence submitted pursuant to 37 C.F.R. §§ 1.130, 1.131, or 1.132 or any other evidence entered by the Examiner and relied upon by Appellant in the appeal.

**NONE**

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**RELATED PROCEEDINGS APPENDIX**

Submitted herewith are copies of decisions rendered by a court or the Board in any proceeding identified above in Section II pursuant to 37 C.F.R. § 41.37(c)(1)(ii).

**NONE**